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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/647,534	08/26/2003	Anthony Dip	240579US6YA	2715

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EXAMINER	
MALDONADO, JULIO J	

ART UNIT	PAPER NUMBER
2823	

DATE MAILED: 02/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/647,534	DIP ET AL.	
	Examiner	Art Unit	
	Julio J. Maldonado	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 November 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,4-8,10-12 and 17-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,4-8,10-12 and 17-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. The addition of claims 21-23 a set forth in Paper filed in 11/17/2005 is acknowledged.

2. Claims 1, 2, 4-8, 10-12 and 17-23 are pending in the Application.

Claim Objections

3. Claim 21 is objected to because of the following informalities: where claim 21 recites, "...wherein said substrate comprises Si(x)Ge(y)...", change to --silicon germanium--. The recitation "Si(x)Ge(y)" in claim 21 is indefinite because there is no description of the suffixes (x) and (y) in the claim. Appropriate correction is required.

Continued Examination Under 37 CFR 1.114

4. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 11/17/2005 has been entered.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1, 2, 5-8 and 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thakur (U.S. 6,589,877 B1) in view of Wolf et al. (Silicon Processing for the VLSI Era, Volume 1: Process Technology).

In reference to claims 1, 5-8, 10, 11, Thakur (Fig.1) teaches a method of cleaning the surface of a substrate comprising silicon including the steps of growing a first layer of silicon oxide by thermal oxidation on the surface of the substrate; first etching said first oxide layer; growing a second silicon oxide layer by thermal oxidation; etching said second oxide layer; and repeating said oxidation and etching steps as desired until removing contaminant or substrate surface damage, wherein said etching steps are performed using a dry etching process wherein said etchant is chlorine gas or hydrogen fluoride gas and wherein said etchant is dissociated to form radicals (Thakur, column 2, line 39 – column 5, line 58 and column 8, lines 10 – 20).

Thakur fails to teach using a plasma process to etch said oxide layer. However, Wolf et al. in a related etching process teach dissociating chlorine and hydrogen fluoride molecules in a plasma environment to form radicals (Wolf et al., page 544, second paragraph). It would have been within the scope of one of ordinary skill in the art to combine the teachings of Thakur and Wolf et al. to enable the etching step of Thakur to be performed according to the teachings of Wolf et al. because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of performing the disclosed etching step of Thakur and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

The combined teachings of Thakur and Wolf et al. fail to expressly teach monitoring said surface region of the substrate and repeatedly growing an additional ultra-thin oxide layer to consume additional defects and etching the additional oxide layer to remove the consumed additional defects based on said monitoring of said surface region. However, it is inherent that there has to be an inspection step to detect level of contaminants on a substrate in order to continue or stopping said growing and etching steps until all of the contaminant or substrate surface damage has been removed.

In reference to claim 2, the combined teachings of Thakur and Wolf et al. fail to teach growing said oxide layers having thicknesses of between approximately 5 Å and 15 Å. One of ordinary skill in the art would have been led to the recited dimensions through routine experimentation and optimization. Applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, In re Rose, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); In re Rinehart, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966). See also MPEP 2144.04(IV)(B).

In reference to claim 12, the combined teachings of Thakur and Wolf et al. teach processing a plurality of substrates including said substrate, wherein each of said growing steps and each of said etching steps is performed on each of said plurality of substrates (Wolf et al., pages 230 – 234, and 568 – 574).

7. Claims 4 and 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thakur (U.S. 6,589,877 B1) in view of Wolf et al. (Silicon Processing for the VLSI Era, Volume 1: Process Technology) as applied to claims 1, 2, 5-8 and 10-12 above, and further in view of Park et al. (A study on modified silicon surface after CHF_3C/C_2F_6 reactive ion etching).

The combined teachings of Thakur and Wolf et al. substantially teach all aspects of the invention but fail to disclose wherein said monitoring comprises using high-resolution transmission electron microscopy (HRTEM) data. However, Park et al. teach a monitoring method to detect level of contaminants on a substrate, wherein said monitoring includes HRTEM (Abstract). It would have been within the scope of one of ordinary skill in the art to combine the teachings of Thakur and Wolf et al. with Park et al. to enable monitoring the reduction of contaminants in the substrate of the combination of Thakur and Wolf et al. according to the teachings of Park et al. because one of ordinary skill in the art at the tie the invention was made would have been motivated to look to alternative suitable methods of monitoring the substrate of Thakur and Wolf et al. and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

In reference to claims 17-20, the combined teachings of Thakur, Wolf et al. and Park et al. inherently teach wherein said monitoring includes imaging the surface of the substrate after removal of one of said ultra-thin oxide layers using HRTEM data. Further support can be found in Wolf et al. (Semiconductor Processing for the VLSI Era, Volume 1: Process technology, pages 586, 587 and 597-599) and Herbots et al. (Figs.6A-6B and column 19, lines 15 – 40) and furthermore, since the same monitoring is used, the same data results would be obtained.

8. Claims 21-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thakur (U.S. 6,589,877 B1) in view of Wolf et al. (Silicon Processing for the VLSI Era, Volume 1: Process Technology) and Maydan et al. (2004/0121605 A1).

Thakur (Fig.1) teaches a method of cleaning the surface of a substrate comprising silicon including the steps of growing a first layer of silicon oxide by thermal oxidation on the surface of the substrate; first etching said first oxide layer; growing a second silicon oxide layer by thermal oxidation; etching said second oxide layer; and repeating said oxidation and etching steps as desired until removing contaminant or substrate surface damage, wherein said etching steps are performed using a dry etching process wherein said etchant is chlorine gas or hydrogen fluoride gas and wherein said etchant is dissociated to form radicals (Thakur, column 2, line 39 – column 5, line 58 and column 8, lines 10 – 20).

Thakur fails to teach using a plasma process to etch said oxide layer. However, Wolf et al. in a related etching process teach dissociating chlorine and hydrogen fluoride molecules in a plasma environment to form radicals (Wolf et al., page 544, second

paragraph). It would have been within the scope of one of ordinary skill in the art to combine the teachings of Thakur and Wolf et al. to enable the etching step of Thakur to be performed according to the teachings of Wolf et al. because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of performing the disclosed etching step of Thakur and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

The combined teachings of Thakur and Wolf et al. fail to expressly teach monitoring said surface region of the substrate and repeatedly growing an additional ultra-thin oxide layer to consume additional defects and etching the additional oxide layer to remove the consumed additional defects based on said monitoring of said surface region. However, it is inherent that there has to be an inspection step to detect level of contaminants on a substrate in order to continue or stopping said growing and etching steps until all of the contaminant or substrate surface damage has been removed.

The combined teachings of Thakur and Wolf et al. substantially teach all aspects of the invention but fail to teach wherein the semiconductor substrate comprises silicon germanium. However, Maydan et al. teach a method of cleaning substrates including forming an oxide layer on a surface of a substrate, followed by removing said oxide, wherein said substrate comprises a material selected from the group including silicon and silicon germanium (Maydan et al., [0047]).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Thakur and Wolf et al. to enable using a substrate in the combination of Thakur and Wolf et al. according to the teachings of Maydan et al. because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of using the disclosed substrate in Thakur and Wolf et al. and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

Response to Arguments

9. Applicant's arguments with respect to claims 1, 2, 4-8, 10-12 and 17-23 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

10. Applicants are encouraged, where appropriate, to check Patent Application Information Retrieval (PAIR) (http://portal.uspto.gov/external/portal/pair) which provides applicants direct secure access to their own patent application status information, as well as to general patent information publicly available.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Julio J. Maldonado whose telephone number is (571) 272-1864. The examiner can normally be reached on Monday through Friday.

12. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith, can be reached on (571) 272-1907. The fax number for this group is 571-273-8300. Updates can be found at http://www.uspto.gov/web/info/2800.htm.

Julio J. Maldonado
Patent Examiner
Art Unit 2823

Julio J. Maldonado
February 4, 2006

George Fourson
Primary Examiner